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WAR DEPARTMENT

TECHNICAL MANUAL

MATERIALS FOR PROTECTIVE CONCEALMENT

October 7, 1942

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SECTION I

GENERAL

1. General.—*a.* Much of the information contained herein is based on actual test and experience; some of it had to be estimated. Many field factors influence coverage and durability of materials, and considerable judgment must be exercised in the use of any application process. A general rule is to apply enough material to obtain a surface of the desired appearance, but not enough to allow the coating to run or to collect in low areas.

b. Charts for each surface show two types of coatings; a paint or stain, and an adhesive for use with a covering of granules or similar materials. As the resultant color is determined by the color of the granules, the color of the adhesive is immaterial. Coloration of the granules before application to the surface produces the most permanent color. However, it is possible to spray the desired color on the surface after the granules have been applied.

c. For satisfactory results it is necessary to follow closely the instructions as to the use of primers.

2. Purpose and scope.—The information contained in this manual is for the use and assistance of all concerned with protective concealment. Essentially, this manual comprises a glossary of paints and coatings for specific surfaces; characteristics, costs, and application data; types of equipment which have been found useful in their application; and a description of materials available for overhead screening and concealment. For a more general and complete statement of camouflage practice see FM 5–20.

Section II

MATERIALS FOR TONING DOWN SURFACES

3. General.—*a.* Frequently it is desirable to tone down or color surfaces to reduce visibility. Results of experiments indicate that three types of coating are satisfactory for this purpose: paints, stains, and adhesives with colored granules or local materials. Paints and stains satisfactory for coloring various surfaces are given in paragraphs 4 to 14, inclusive. Adhesives and granules used to furnish an artificial depth of texture are discussed in paragraph 15.

b. The types of paints and stains listed have proved to be satisfactory coatings for the purposes indicated. They are not the only ones that will be satisfactory for each surface, but they are preferred.

4. Cold water paint, protein base (Corps of Engineers Tentative Specification No. T–1093b).—*a.* Protein paints consists of a mixture of casein or soya protein combined with suitable pigments and extenders in such a manner that when mixed with water to a brushing or spraying consistency a coating material is obtained that dries in about 30 minutes to a hard, flat surface. The protein acts as a glue, binding down the color pigments. While it is possible to make protein glues that become insoluble in water when dry, such compounds are not satisfactory as coating materials. Hence, protein paints, while somewhat water-resistant, are not washable. Over long periods of time they develop resistance to water, but the time element is too long for most military purposes. There have been instances where protein paint, completely dry and 2 weeks after application to buildings, has been washed off altogether by a heavy rain.

b. The specification paint referred to in *a* above is not recommended for use on surfaces other than fabrics, except where a temporary need for color exists.

c. The paints are supplied in either a powder or a paste form. The powder is reduced (diluted) with water, using 5 pounds of powder and 5 pints of water for about 1 gallon of paint. One gallon of the paste form is reduced with ½ gallon of water, yielding 1½ gallons of paint. The cost of the powder ranges from 10 to 15 cents a pound and the paste from $1.00 to $1.75 per gallon. Due to its high water content, the paste form must be protected from freezing while in storage. Neither of the reduced forms is suitable for use in subfreezing temperatures.

d. Fabrics such as osnaburg and burlap may be impregnated with reduced protein paints for use as garnishing materials. The fabrics are dipped in the paint, wrung out, and allowed to dry. In this case, the resistance to the washing action of rain is fairly good, probably due to the large amount of paint retained in the porous fabric.

5. Asphalt (bituminous) emulsions (pigmented) (Corps of Engineers Tentative Specification No. T–1224, Class B).—*a.* Bituminous emulsions consist essentially of asphalt, water, and an emulsifying agent. The latter is either clay (Bentonite) or a soap. Bentonite has the property of absorbing many times its own weight of water without turning into a slurry; hence emulsions of the clay type may carry as much as 70 to 75 percent of water. The soap

type of emulsion is much thinner in body and usually contains not more than 35 percent of water. The latter type of emulsion will give a more durable paint, as it contains a much higher percentage of solids. Both types of emulsions may be combined with pigments to obtain any of the standard camouflage colors. In the case of the lighter colored paints an albino asphalt is used, as the staining power of black asphalt would prohibit its use.

b. Bituminous emulsions are relatively slow drying and remain soft throughout the life of the coating. They dry with a medium gloss which dulls rapidly on exposure. Due to their soft nature, they should never be used on machinery or applied to moving parts. They should be reduced with water according to the directions of the manufacturer, and may be applied by either brush or spray. Because of their aqueous nature, they are particularly suitable for application on damp surfaces or under humid conditions, but trouble due to crawling of the film may be experienced in cold weather. When used over metal, precautions must first be taken to protect the metal from corrosion, by the use of a corrosion-resisting primer, since the bituminous emulsions are likely to allow pinholes to form in the coating when exposed to heavy rains. If allowed to dry for 2 or 3 hours after being applied, they become resistant to washing and will not be harmed by rain, even if the film is not yet completely dry. Freezing breaks the emulsion and makes the paint unfit for use even after being warmed to normal temperatures; hence bituminous emulsions should be kept from freezing.

c. Pigmented emulsions are recommended for use over a prime coat of unpigmented bituminous emulsion (Corps of Engineers Tentative Specification No. T–1224, Class A) for coloring texturing materials to simulate the color and texture of surrounding terrain. The Class A emulsion is reduced with an equal volume of water for use as a prime coat. A prime coat should always be used whenever the pigmented emulsions are used on surfaces subject to traffic, such as runways. On such surfaces as old structures, temporary construction, and surfaces not subject to abrasion, they may be used without a primer.

d. The bituminous emulsions are particularly recommended for use over tar or asphalt roofs, or any surface previously coated with bituminous material. Surfaces previously coated with bituminous materials cannot be coated with any other type of coating because the asphalt will "bleed" through and cause staining. Due to their low cost, bituminous emulsions are being used where other types of coatings would be better suited. The use of pigmented bituminous emulsions should be restricted to those surfaces for which they are

specifically recommended, that is, concrete or bituminous surfaced runways, asphalt or tarred roofs, and surfaces previously coated with bituminous emulsions. The reasons for this are:

(1) Because of the black color of the bituminous base, much larger quantities of critical pigments are required to obtain the desired color than is the case with any other type of finish. Such pigments include chromium oxide and precipitated iron oxides. Chromium is required for metallurgical purposes and the equipment available to produce iron oxides is taxed to capacity.

(2) Bituminous emulsions chalk rapidly, fade, and allow the black to bleed through, especially in hot weather. Fading is pronounced in the Pacific coast climate.

(3) Because of pinholes forming after continued exposure to rain, poor protection is given metal when bituminous emulsions are used as the only finishing material.

(4) Frequently excessive "bodying" occurs in the container during storage. Cases are known where as much as 2½ gallons of water were required to reduce 1 gallon of emulsion to a consistency suitable for use. This cuts down the hiding power, reduces durability, and causes cracking of the film over some types of surfaces.

(5) There are only two or three basic manufacturers of the emulsions. Other suppliers buy the emulsion base in a concentrated form, pigment it, and reduce it. Thus there is a lack of knowledge among the suppliers as to the proper formulation and application of the material.

(6) Because of bleeding of the bituminous material, surfaces once coated with bituminous emulsions cannot be recoated with any other type of coating.

(7) Bituminous emulsions are hard to apply on cold, damp surfaces and require 2 to 3 hours of drying before becoming resistant to rain.

e. Bituminous emulsions range in cost from $0.60 to $1.20 per gallon, the latter figure applying to the green colors, which require more expensive pigments.

6. Oleoresinous paint (emulsifiable) (Corps of Engineers Tentative Specification No. T–1279).—*a.* In order to provide a material that could be reduced with either water or an organic solvent, an oleoresinous paint miscible with water has been developed. As its name implies, it consists of suitable resins dispersed by heat in vegetable oils and combined with the necessary pigments and extenders. Supplied in the form of a heavy paste, it may be reduced either with gasoline or water and applied by brush or spray gun. Since the paste contains no water, it is not subject to freezing. When reduced

with gasoline it may be used in subzero temperatures. Because of its high resin content, low temperatures do not retard its drying properties. For use on wood or previously primed metal, the heavy paste is reduced with gasoline or water, using 1 gallon of paste to 1 gallon of liquid.

b. This type of paint is quite durable, although not equal to a straight oil type. It is suitable for use under cold, damp conditions, and becomes resistant to the washing action of a hard rain within ½ hour after being applied. In some instances it has been used successfully over surfaces previously coated with bituminous compounds; however, such performances cannot be guaranteed but depend to a large extent on the nature and condition of the bituminous coating.

c. These paints are particularly suitable for the impregnation of fabrics, being superior to the protein base paints for this purpose. One gallon of the paste is reduced with 3 to 4 gallons of water and applied to fabric by dipping. Due to the large amount of water that can be added to the paste without reducing its hiding power, 1 gallon of the paste will impregnate 2½ times as much fabric as a corresponding quantity of protein base paste or powder.

d. Oleoresinous paint is available in all of the standard camouflage colors, ranging in cost from $1.50 to $2.00 per gallon of heavy paste.

7. Oil-base paint (Corps of Engineers Tentative Specification No. T–1215).—*a.* This type of coating material consists of a drying oil, usually linseed oil, and mineral thinner, combined with suitable pigments and extenders. It dries overnight to a fairly elastic film. It gives excellent protection against the weather and can be applied by brush or spray. For spray gun application, it is necessary to thin the paint with mineral spirits or gasoline, using about 1 quart of thinner to 1 gallon of paint. The gloss is very low. It is recommended for use over wood and previously primed metal surfaces.

b. On new wood construction, it has been necessary to apply more than one coat of this paint to secure the necessary hiding power and protection from weathering. Over soft wood and other porous surfaces, as many as three coats may be required.

c. To insure a satisfactory result by using only two coats, a primer has been developed for use on new wood construction. It has been designed to have high covering power and to be of a nonpenetrating nature; it is described in Corps of Engineers Tentative Specification No. T–1287. One coat of the primer will seal the surface effectively and provide a uniform base on which to apply a

single finishing coat of the oil-base camouflage paint. It is supplied in a neutral, light reddish-brown shade which may be used under any of the standard camouflage colors.

d. New wood structures primed with one coat of the primer and finished with one coat of oil-base camouflage paint will exhibit the following advantages over such surfaces finished with two or three coats of the oleoresinous paint:

(1) Greater uniformity of color.
(2) Considerably greater durability.
(3) Retention of the original color for a longer period of time.
(4) Saving of time and labor.

e. The specification paint should not be confused with ordinary linseed oil paints. The latter dry with a high luster and are more durable, as they contain a much higher percentage of linseed oil.

f. The cost varies from $0.80 to $1.20 per gallon.

8. Gasoline-soluble paints (Corps of Engineers Tentative Specification No. T–1227).—*a.* These paints are supplied in powder form and consist of suitable pigments dispersed with a powdered resin, such as zinc resinate or cumar, which is readily soluble in gasoline. Sufficient gasoline is mixed with the powder to yield a paint of brushing or spraying consistency. From 4 to 5 pounds of powder are required for each gallon of paint. The resulting paint is flat, quick drying (15 to 20 minutes), durable for several months, and capable of being easily removed by washing with gasoline. It should be used only on surfaces which are not affected by gasoline. Cold weather does not retard the drying; hence these paints are suitable for use in subfreezing temperatures. Their rapid rate of drying and easy removability make them ideal for use in painting identification marks or designs on equipment and vehicles.

b. The following precautions should be observed in using paints of this type:

(1) The mixture is highly inflammable and should be used in well-ventilated or open places and kept away from open flame or fire.

(2) Because of its poisonous nature, the use of leaded gasoline should be avoided. If its use is necessary, the usual health precautions should be exercised.

(3) Sufficient time should elapse after adding gasoline to the powder mixture to insure the resin being completely dissolved; 1 to 2 hours are desirable. If this is not done the paint will dust off from the surface to which it has been applied.

c. The cost ranges from 21 to 46 cents a pound.

9. Cement paints (no Government specifications applicable).—*a.* Cement paints are marketed in powder or liquid form and contain cement, which is the binding material, and suitable pigments. The liquid type may contain drying oils. Because the cement acts as a pigment as well as a binder, the paints normally are available in a range of light colors. The durability of the darker camouflage shades is decreased on account of the great amount of pigment required to color the cement. The material is thinned with water according to the directions of the manufacturer. Normally, it is applied by brushing, as it has an abrasive action on spray equipment.

b. Cement paints are not suitable for wood or for metals subject to corrosion, as the resulting finish is porous and does not protect the surface. However, for the same reason, cement paints are desirable for tile roofs or similar types of surfaces where a color coating is desired without impairing the porous nature of the surface. This is particularly important in the case of the tile roofs in the Tropics, where it is understood that tile is destroyed by mildew etch if the surface is sealed. Cement paints may be applied over a weathered, oil-painted surface, but oil paints do not give good results when used over cement paints. They are recommended for coloring concrete, brick, stucco, masonry, and tile surfaces which are not subject to abrasion. They are not suitable for use on runways, roads, or other traffic-bearing surfaces.

c. The powder form of cement paint ranges in cost from 5 to 10 cents per pound. The cost of the liquid form varies, depending on the particular composition used by the manufacturer.

10. Traffic paints (no Government specification applicable).—Traffic paints are mixtures of fast-drying varnish combined with pigments and extenders. They are high in pigment content, dry in approximately ½ hour, and present a flat surface that is highly resistant to traffic abrasion. There are two basic types in general use: the oleoresinous type and the spirit varnish type. The former is based on a varnish prepared by dispersing suitable resins in drying oils and thinned to a suitable consistency with mineral spirits or turpentine. The spirit varnish type is made from natural resins dissolved in an organic solvent such as alcohol.

11. Stains for wood (no Government specifications applicable).—*a.* There are several types of stains suitable for toning down new wood construction or for use over previously stained surfaces. All of them dry in approximately 8 to 12 hours to a flat finish having fair durability. Most of them are permanent in color. They are applied by

brushing and may be thinned, if necessary, with mineral spirits or turpentine. The most common types are—

(1) *Oil stains.*—As their name implies, oil stains consist of suitable dry colors ground in a drying oil (linseed) and reduced with linseed oil and thinner. The thinner usually is a mixture of mineral spirits and kerosene. Surfaces stained with oil-type stains may be painted over with any other type of coating material without danger of the stain bleeding through.

(2) *Asphalt stains.*—These stains consist of pigments ground in linseed oil and reduced with an asphalt varnish and thinned in a manner similar to the oil stains. Their general characteristics are the same as the oil stains.

(3) *Creosote stains.*—Usually creosote stains consist of pigments ground in linseed oil and reduced with a mixture of creosote oil, kerosene, and mineral thinner. Occasionally they may be made from colors ground in japan drier in place of the linseed oil and may or may not contain some paraffin oil. The creosote acts to preserve the wood to a certain extent. Surfaces stained with creosote stains cannot be painted over with other types of paints, as the creosote will bleed through and cause a dirty, brown stain.

b. All of the above stains are relatively cheap and have a high coverage, around 600 square feet per gallon.

12. Cement stains (no Government specifications applicable).—*a.* The usual commercial type of cement stain consists of dyes or pigments dissolved or suspended in water or organic solvents, with or without oil, which penetrate the surface and impart color without any protecting film. They are suitable for coloring tile roofs in the Tropics for the reason indicated in paragraph 9. They may be applied by either brushing or spraying. The results of tests indicate that the commercial stains do not have sufficient permanence of color for exterior use in any color other than brown. Except in the latter color, they are rather expensive.

b. The following mixtures have been found to be suitable for use in staining concrete a dark brown:

(1) Xylene and tar (RT-2) in solution, 20 percent xylene and 80 percent tar, produce a very dark brown surface. A lighter color can be obtained by decreasing the percentage of tar. It can be applied by brush or spray and dries fairly rapidly. The cost of this stain is about 15 cents per gallon.

(2) Various mixtures of kerosene and asphalt give a dirty, brown surface. A solution of 75 percent kerosene and 25 percent asphalt has produced a satisfactory color. It yields a surface which remains

spotted or mottled in appearance and has a medium gloss which disappears in a few days. The cost is about 11 cents per gallon.

(3) Class A, nonfibrated, nonpigmented bituminous emulsion (Corps of Engineers Tentative Specification No. T–1224) diluted with four times its volume of water to which a wetting agent (2 percent by weight of tetra sodium pyrophosphate) has been added gives a satisfactory dark brown stain, but it is not as permanent as might be desired. However, the cost is so low, 5 cents per gallon, that it may be desirable to recoat as the color fades out. This stain is particularly recommended in supplementary treatment to lessen the visibility of concrete surfaces covered by camouflage nets, thus reducing the amount of garnishing required.

c. A new material for staining concrete a dark green color has been developed which is easy to apply, quite low in price, and appears to be sufficiently permanent in color. Tests have not been completed on this stain, but results are promising. Concrete, particularly where broomed, possesses a definite inherent texture which may be emphasized by a coloring material which does not have a binder or film. Such a coloring material consists of a green, water-dispersible pigment stain of the following composition:

12 pounds water-dispersible green.
3.2 pounds aluminum sulfate.
20 gallons water.

This mixture is sprayed on the concrete at a rate of 300 square feet per gallon. After drying, a fixing coat is sprayed over it at a rate of 150 square feet per gallon, as follows:

4 gallons sodium silicate (8.9 percent Na_2O; 28.7 T SiO_2).
16 gallons water.

The drying time of the first coat is approximately 5 minutes; traffic may be allowed to cross the surface before the fixing coat is applied. The fixing coat dries in about the same time as the first coat. Both of the following combinations of water-dispersible green have appeared satisfactory in preliminary tests:

Composition No. E5819

	Percent
Water-dispersible hansa yellow G	21
Yellow iron oxide (precipitated)	9
Black iron oxide	20
Chromium oxide	50

Composition No. E5821

	Percent
Water-dispersible chlorinated phthalocyanine green	14
Water-dispersible hansa yellow G	27
Yellow iron oxide (precipitated)	25
Black iron oxide	34

It is suggested that either of these pigment compositions be obtained already blended from commercial pigment manufacturers. Suitable material has been supplied by the C. K. Williams Company, Easton, Pennsylvania. The total cost of this treatment is 2 to 3 cents per square yard. A tentative specification is being prepared covering this product and will be available at an early date.

13. Cut-back asphalt (Federal Specification No. SS-A-671A, for the S. C., M. C., and R. C. types).—*a.* Cut-back asphalt consists of a petroleum asphalt residue in a petroleum solvent. There are three types:

(1) S. C., or slow cure; contains crude oil as the solvent.

(2) M. C., or medium cure; contains kerosene as the solvent.

(3) R. C., or rapid cure; contains gasoline as the solvent.

b. The S. C. or slow cure type of cut-back is preferable for coloring dirt or unpaved surfaces because the oil does not evaporate and penetrate the ground to a great extent. The M. C. and R. C. series can be used as adhesives or as coloring agents on dirt where a dirty brown color is desired at a low cost. The coatings are applied best by a standard asphalt distributing truck, but can be sprayed on by the mobile applicator or portable spray unit described in section III. Cut-backs cost from 7 to 12 cents per gallon.

14. Miscellaneous materials. — Various materials have been tested for use on specific surfaces of various types. Those that have shown promise of having desirable properties are listed below. Tests have not been completed on these products, but indications are that they will be satisfactory for the use indicated.

a. Galvanized iron.—As a general rule, paint will not adhere to new galvanized surfaces unless such surfaces are etched before being painted. Two paints tested giving indications of good adherence and long life are L. & S. portland cement paint and Wonderguard.

(1) L. & S. paint is made of a cement base, dries to a flat finish, is durable, and presents a finish of sufficient texture not to be reflective. It has been reported to have had wide use on the Pacific coast and is manufactured by L. & S. Paint Company, San Francisco, California.

(2) Wonderguard is a phenolic-resin-base paint that dries in 10 minutes to a tough, flat surface. Accelerated weathering tests point to

excellent durability. It is manufactured by Wondersheen Corporation, Richmond, California.

b. Protein-cement paint.—Combinations of casein and cement, available in powder form, are suitable for use on many surfaces. They contain approximately 50 percent of cement and are mixed with water in the ratio of 5 pounds of powder to 5 pints of water. They dry rapidly to a hard, flat surface that becomes resistant in several days' time to the washing action of rain. In this respect they are far superior to the cold water protein paints. They may be used over wood, primed metal, or masonry surfaces. The average durability is estimated at 1 year. The cost is slightly higher than that of the ordinary protein paints.

c. Infrared reflective paints.—(1) Most infrared reflective paints are made with an important strategic pigment, a compound of chromium, which in a number of different manufacturing processes is vital to the war effort. It is therefore considered essential, in order to avoid misuse and waste of chromium pigments, that infrared reflecting paints be used only where they are necessary and desirable.

(2) It is known generally that most growing foliage, with the possible exception of some coniferous trees and many types of ground surfaces, reflects infrared light to a considerable degree and thus appears light to medium gray when photographed with infrared film. Dead foliage and most ordinary paints and other surfaces, including many camouflage materials, photograph dark or black under the same circumstances. Thus, when detection by hostile infrared photography is a consideration, camouflage should include the use of paints which have infrared characteristics of the same order as the surroundings. In many cases this will require the use of ordinary paints with no infrared reflectivity.

(3) When the lines and shadows of an installation are visible to the eye and the installation can be recognized easily on ordinary panchromatic film, coating material of high reflectance in the infrared region of the spectrum is definitely not desired or necessary. Only installations which are so completely camouflaged that their telltale lines and shadows are broken and otherwise obscured, and which are located in terrain of a nature which reflects highly in the infrared portion of the spectrum, should receive the added protection of infrared reflective coating material.

(4) When military vehicles and other material are camouflaged with pattern painting, one or two of the colors used may well have a reasonably high infrared reflectivity. The remaining color or colors, usually black or olive drab, do not require this characteristic.

15. Adhesives and granules.—*a. Importance of texture.*—(1) The actual value of artificial texture is a somewhat controversial issue. Recent investigation tends to indicate that texture, although possessing definite value, may be important only under certain limited circumstances. It has been observed that surfaces with rough texture applied artificially and surfaces which are smooth when painted the identical color are indistinguishable when viewed from vertical or high angles of observation and when the sun is high in the sky. On the other hand, when the sun is at a low angle, under 30°, and the angle of observation is similar, looking back toward the sun, the textured surface is much darker and closer to the intended color than the smooth painted surface. At this angle of illumination and observation the reflection of light from smooth surfaces is so great that, without texture, black and white could not be distinguished from each other. This is a phenomenon which might be called loss of color identity.

(2) It will be observed that the circumstances where texture becomes valuable are those which exist at the hours customary for daylight attack; that is, within a few hours after sunrise and a few hours before sunset. If the attack is made "down-sun" in order to keep the attacker between the sun and the defender, this loss of color identity does not occur and consequently the value of texture is diminished. On the other hand, if the attacker approaches on the opposite side of the target from the sun, the high reflectance of the target may be observed and may facilitate its discovery.

(3) These factors should be kept in mind in determining whether or not a surface is to be artificially textured. They should be balanced against the factors of increased time and expense required for the application of artificially textured surfaces.

b. Types of adhesives.—(1) There are a number of adhesives useful for camouflage purposes. By far the most common type is the bituminous adhesive. Other types which have limited application include ethyl cellulose, varnish, and ordinary glue. Because of the satisfactory nature of the bituminous adhesives and their low cost compared to other types of adhesives, they are used exclusively for the majority of camouflage installations, for example coating runway surfaces, sides or roofs of buildings, and similar large-scale requirements for adhesives. The other adhesives mentioned are used exclusively for small-scale jobs such as coating window glass for reduction of light reflectance.

(2) There are three types of bituminous adhesives: bituminous emulsions, cut-back asphalt, and asphalt cement. Bituminous emul-

sions are divided into two classes: rapid-breaking and slow-breaking emulsions. The former, or so-called static type, should be used on vertical or sloping surfaces; the latter, on horizontal surfaces. Cut-back asphalts, described in paragraph 13, are used for purposes similar to the bituminous emulsions; the R. C. type is comparable to the rapid-break type and the S. C. type to the slow-break type. Although the R. C. type dries more quickly than the bituminous emulsion, tests have shown that the cut-backs used on runways have a tendency to peel up in hot weather under conditions where the bituminous emulsions remain satisfactory.

(3) Asphalt and bituminous emulsions of the nonpigmented type are described in Corps of Engineers Tentative Specification No. T–1224, Class A. This adhesive is of the slower breaking type recommended for horizontal surfaces. It is very similar to the material specified in Federal Specification No. SS–A–674, Type 5. For coating vertical or sloping surfaces, Federal Specification No. SS–A–674, Type 2 material should be used. The latter is of the quick breaking or static type previously referred to. It sets up too quickly to be applied by brushing and must be applied by spraying. Bituminous emulsion, Class A, Corps of Engineers Tentative Specification No. T–1224, costs approximately 7 cents per gallon in tank car lots and 12 cents per gallon in 55-gallon drums.

(4) The adhesive selected depends on the size of the granule. For small granules a dense, light adhesive such as the bituminous emulsion is recommended; for large-size granules such as asphalt chips or crushed rock, the asphalt cement type of adhesive is recommended. The granule which is to be used to produce the texture on the surface should be chosen before the adhesive.

(5) For use in the Tropics where surfaces reach excessively high temperatures, it is desirable to use the thinnest coating of bituminous adhesive possible in order to avoid softening of the asphalt and consequent skidding of traffic. For this reason, the size of the granule used at these locations is limited to one which can be retained satisfactorily in a thin adhesive.

(6) In tropical climates where the surface is subjected to excessive wetness for extended periods of time, application of the adhesive is as important as the proper choice of the material itself. It has been found that where the surfaces are not thoroughly cleaned with brush and water before application of the adhesive, dust is present between the adhesive and paved surface. Apparently, water penetrates the dust and by a capillary action seeps under the adhesive, destroying its bond with the paved surface. This destruction of the bond is

facilitated by the use of a porous granule such as sawdust. In order to minimize this action, precolored sawdust should be used. It is recommended that prior to the application of the full-strength bituminous emulsion, Class A, and after the surface has been thoroughly brushed with water, the surface be coated with a solution of Class A bituminous emulsion diluted with two times its volume of water. This prime coat should then be allowed to dry for a period of at least 8 hours.

c. Types of granules.—(1) The best texture granules tested to date have been chopped scrap rubber. Unfortunately, due to the strategic nature of rubber, other materials must be used. Sawdust or wood planer chips dyed to the desired color perform satisfactorily and furnish good texture material.

(2) Colored mineral granules of various sizes also provide a good texturing material. They furnish a reasonably durable surface without excessive wear characteristics. In many sections of the country, particularly the far west, there are outcroppings of varicolored rocks which, crushed to small sizes, are suitable for texturing road surfaces. The color of the rock is sufficiently close to the surrounding terrain to require no painting.

(3) Sand, because of its fine particle size, does not produce a deep-textured surface, but is suitable for imitating road surfaces. Coarse, graded soils of distinctive color are sometimes useful.

(4) Medium hard asphalt chips, ¼ to ½ inch in cross section, have shown promise in tests. The chips can be precolored by mixing with a suitable pigmented bituminous emulsion, Corps of Engineers Tentative Specification No. T–1224, Class B, in an ordinary concrete mixer, or spraying the surface with the same emulsion after application of the chips to the adhesive.

(5) Coloring of materials such as sawdust or wood chips for texture can be accomplished with a minimum amount of paint by precoloring rather than spraying the granules after their application to the adhesive. The precoloring technique also preserves the maximum texture of the granules. A simple method of precoloring granules is to use a concrete mixer. Either the granules or the paint can be placed in the mixer first, sufficient granules or paint being added to impart the proper color and leave no free paint. Experience with first-cut sawdust indicates that the following proportions are satisfactory: one volume of bituminous emulsion, pigmented, Class B, to three volumes of water and nine volumes of sawdust. It is necessary to thin the paint with the three volumes of water to avoid matting of the sawdust as it dries. If the paint is sufficiently thinned, no difficulty will be incurred in drying the

sawdust. In drying the sawdust or other granules, they should be spread on a screen built of ordinary wire fly screening. The optimum thickness for efficiency and rapid drying is about 1 inch and no thicker than 2 inches. During the drying operation, the material should be periodically raked to avoid any tendency to mat.

d. Application.—(1) Emulsions and cut-backs usually are applied at a rate of 0.1 to 0.3 of a gallon per square yard, depending upon the thickness of the coating desired. Suitable granules are sawdust, wood chips, dirt, fine gravel, bagasse, slate granules, or similar small materials. The specified emulsions and cut-backs can be applied by brush, heavy-duty spray equipment, or commercial road distributors.

(2) When using asphalt cement, the surface should first be washed with water. A prime coat of asphalt emulsion is recommended. The emulsion is reduced with an equal quantity of water, and the thinned solution is applied at a rate of 0.1 gallon per square yard. The prime coat is allowed to dry for at least 1 day of dry weather. It is followed by a coat of asphalt cement, using about 0.8 gallon per square yard. The cement is applied hot, about 250° F., using commercial road equipment. For application in hot climates, asphalt of the highest softening point is desirable.

(3) Granules are thrown on the adhesive immediately after its application and rolled after 1 or 2 hours and again after 24 hours. The surplus granules then can be brushed off, using a light broom. Large-size granules, such as asphalt chips, wood chips, tan bark, coarse gravel, or crushed rock are suitable for use with asphalt cement.

(4) Bituminous runways, particularly those of asphaltic concrete, present a problem which is best treated by texturing. Texturing by the sawdust method has proved the cheapest and most satisfactory. After the sawdust has been applied upon a tack coat or binder, it is necessary to use a coloring material which will color by penetration, have no binder, and retain the effect of texture provided by the granules. A stain similar to that recently developed for the staining of concrete runways will answer these requirements. The composition is as follows:

Sawdust stain SG	*Percent*
Water-dispersible hansa yellow 10 G	6.7
Water-dispersible hansa yellow G	3.3
Water-dispersible indigo blue	3.3
Water-dispersible chlorinated phthalocyanine green	.2
Chromium oxide	72.
Yellow iron oxide (precipitated)	14.5

Forty pounds of the above mixture are stirred into 100 gallons of water in the following manner: Add water slowly to 40 pounds of the pigment mixture while stirring constantly, using only enough water to make a heavy paste. When a smooth paste is obtained, the balance of the water is slowly added with constant agitation. This procedure must be followed to insure complete blending of the pigments. The stain is sprayed over the surface at a rate of 300 square feet per gallon. No fixing solution is required as is the case with the concrete stain. As suggested in the case of the concrete stain, it is advisable to secure the above pigment mixture already blended by a pigment manufacturer rather than mixing the individual pigments. This solution costs about 15 cents per gallon. Satisfactory material has been supplied by the C. K. Williams Company, Easton, Pennsylvania.

SECTION III

EQUIPMENT

16. Spray equipment.—*a.* Any of the paints suitable for use in camouflage may be applied by spraying, using standard commercial equipment. The choice of spray gun nozzle and the operating pressure for each type of material should be determined from the manufacturer of the spray equipment.

b. Satisfactory results have been obtained using a portable paint spraying unit (Corps of Engineers Tentative Specification No. T–1153b) suitable for oversea use or for troops in forward areas (fig. 2). This equipment is recommended necessarily for work on airfields and similar installations in the continental United States. This is because it has been designed to give the best performance consistent with light weight and high mobility. It consists of a lightweight, portable, gasoline engine air compressor and air tank mounted on a light, mobile carriage, two pressure tanks, two paint guns, and all necessary hose, couplings, valves, gages, etc. The compressor is suitable for operating continuously at 80 pounds per square inch. The atomization type spray guns are suitable for use with cold-water paint, asphalt emulsions and cut-backs, oil paints, oleoresinous paints, enamels, and lacquers at speeds to cover not less than 3,000 square feet per hour, using not over 8 cubic feet of compressed air per minute at 50 pounds per square inch pressure. The pressure tanks are of

NO. 1 LIGHT GREEN

NO. 2 DARK GREEN

NO. 3 SAND

NO. 4 FIELD DRAB

NO. 5 EARTH BROWN

NO. 6 EARTH YELLOW

NO. 7 LOAM

NO. 8 EARTH RED

NO. 9 OLIVE DRAB

FIGURE 1.—Standard camouflage colors.

Fig. 1, TM5-269

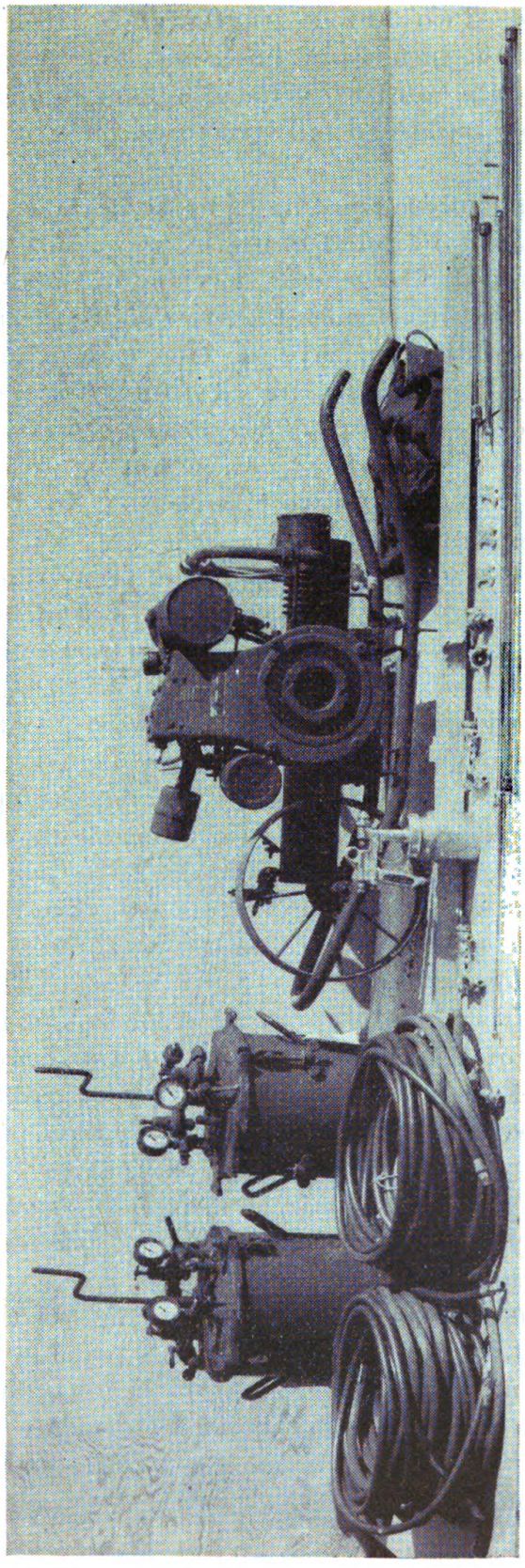

FIGURE 2.—Portable paint spraying unit.

5-gallon capacity. Two 30-foot lengths of 5/16-inch air hose, two 30-foot lengths of 3/8-inch paint hose, and four 50-foot lengths of 3/8-inch main line air hose are included. This unit is recommended for use in painting buildings and structures, but not for large horizontal areas.

c. For use in camouflage painting of buildings and similar installations in the continental United States, a heavy-duty paint spraying unit has been designed. In general, it is similar to the unit described in *b* above except that it is made of heavier and less critical materials and, while portable, does not have the same ease of mobility. Pressure tanks of 10-gallon capacity are substituted for the 5-gallon size. It is described in detail in Corps of Engineers Tentative Specification No. T–1583.

d. Corps of Engineers Tentative Specification No. T–1291 describes a mobile spraying unit, pressure type (fig. 3). This is designed to spray directly from a standard 55-gallon shipping drum and is recommended for spraying large areas quickly. Excellent results have been obtained with this equipment in spraying runways with either adhesives or paint, and it is sufficiently mobile for the painting of hedge rows or other special patterns. The equipment consists of a four-wheeled dolly mounting a 1-horsepower, single cylinder, gasoline engine driving a 3½-cubic-foot-per-minute air compressor. Adequate supports and clamps are provided to enable the shipping drum to withstand the normal operating pressure of 30 pounds per square inch. Two 20-foot spray hoses are furnished. The two spray guns, approximately 4 feet long, are provided with three types of nozzles, to spray in the following manner:

(1) A wide, soft sheet application of emulsions or light cut-backs where a coverage of 1/6 gallon per square yard or heavier is desired.

(2) A finely diffused spray at approximately 4 gallons per minute for coating extensive areas rapidly with 1/10 gallon per square yard or heavier.

(3) A conical spray for asphalt emulsion, cut-back, or material of similar consistency at approximately 4 gallons per minute at a rate of 1/10 gallon per square yard or heavier.

(4) A fine diffusion for applications requiring less than 1/10 gallon per square yard at a rate of 2½ to 3 gallons per minute. The Tarrant Manufacturing Company, Saratoga Springs, New York, has supplied this type of equipment and its performance under adverse conditions has been excellent. As much as 20,000 square yards can be covered in an 8-hour day.

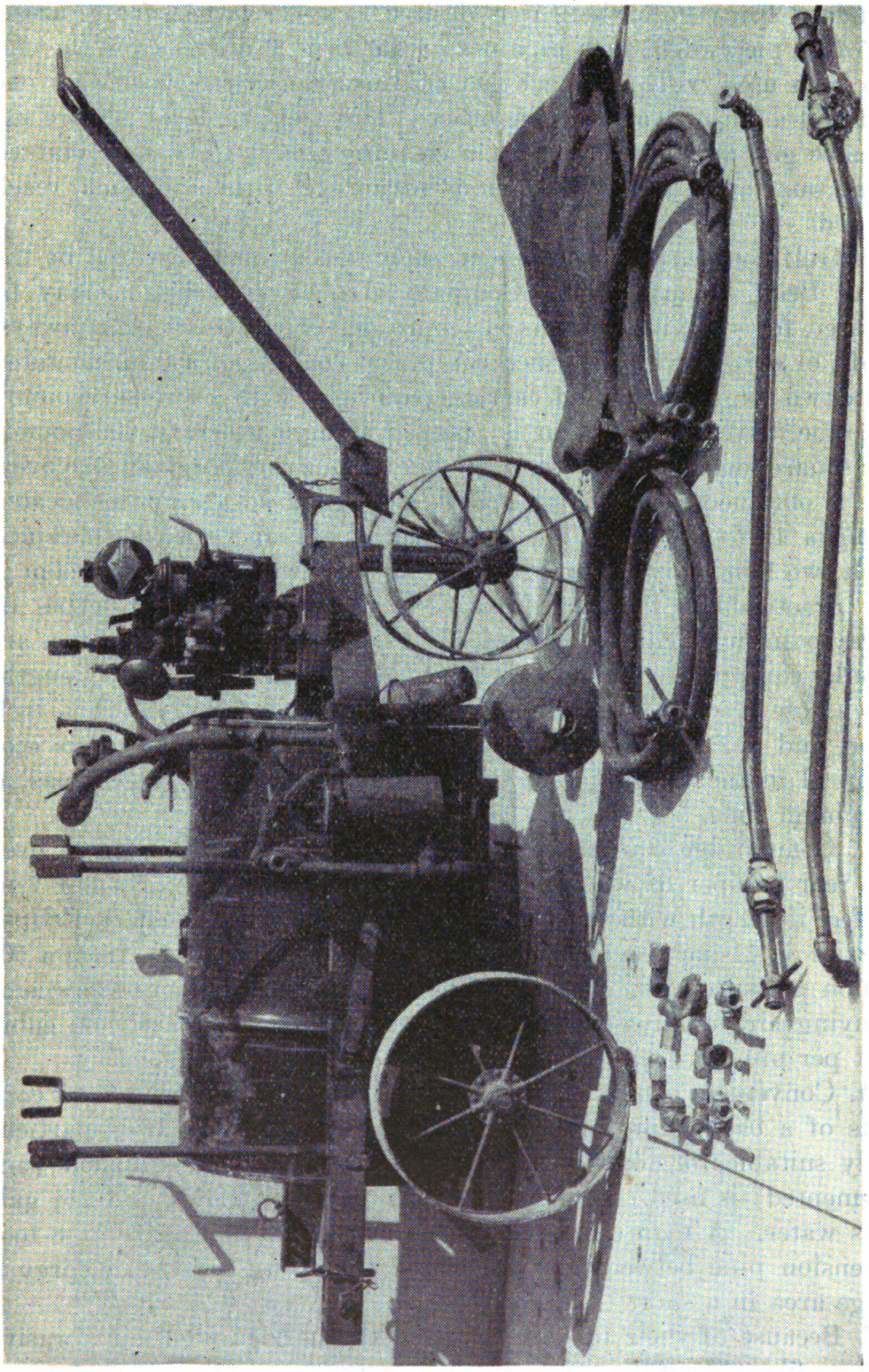

FIGURE 3.—Mobile paint spraying unit, pressure type.

e. A simplified extension nozzle has been improvised to replace a standard spray gun where it is desired to cover large surface areas. A 5-foot piece of ¼-inch pipe with a 45° bend 6 inches from the end has been used with a ¼-inch No. 0 Binks Spray-rite nozzle on one end and a cut-off valve at the other. This item replaces a more expensive gun and saves ½ hour in cleaning time. Coverage obtained is the same and there is the obvious advantage of the additional reach gained.

f. Golf course spray equipment, such as that manufactured by the John Bean Manufacturing Company, Lansing, Michigan, may be utilized for spraying bituminous emulsions or cut-backs on runways, roofs, or earth surfaces. Such equipment consists of a tank mounted on a two- or four-wheeled carriage equipped with a pressure pump, gasoline driven. The paint is pumped at high pressure, 300 pounds per square inch, and because of the fine atomization, high spray coverage is obtained. The paint is delivered to 12 spray nozzles located along a 12-foot boom. The Bean equipment may also be obtained with two hand nozzles for painting surfaces where a bar or boom is not practicable. This has been used successfully for all types of spray painting including barracks and structures. Such machines are usually equipped to handle 2 to 4 lines of hose, each 100 feet in length. Each hose is equipped with a lever cut-off, a 30-inch length of ¼-inch pipe, and an angle nozzle with paint disk. This equipment is economical in the use of paint and permits covering of large areas in minimum time.

g. Comparable equipment may be improvised using a truck, over the rear bumper of which is attached a rig consisting of a bar 7 to 10 feet in length with approximately eight standard Binks or Eclipse nozzles on 11-inch centers and a ¾-inch garden hose feed from a 50-gallon pressure tank (fig. 4). Pressure is supplied from an accompanying air compressor with a capacity of approximately 60 cubic feet per minute.

h. Convenient equipment for touching up or maintaining work consists of a back pump orchard sprayer, 3-gallon size. It is particularly suitable for tone-down work where bituminous emulsion (unpigmented) is used. It is loaded with ¾ gallon HRM and 2¼ gallons water. A man carries it on his back, and using a 6- or 8-foot extension pipe between the valve and the spray head, can spray a large area in a short time.

i. Because of their tendency to clog the nozzle and their abrasive action, fibrated bituminous emulsions require a special type of spray gun for their application. One type of gun found satisfactory is the

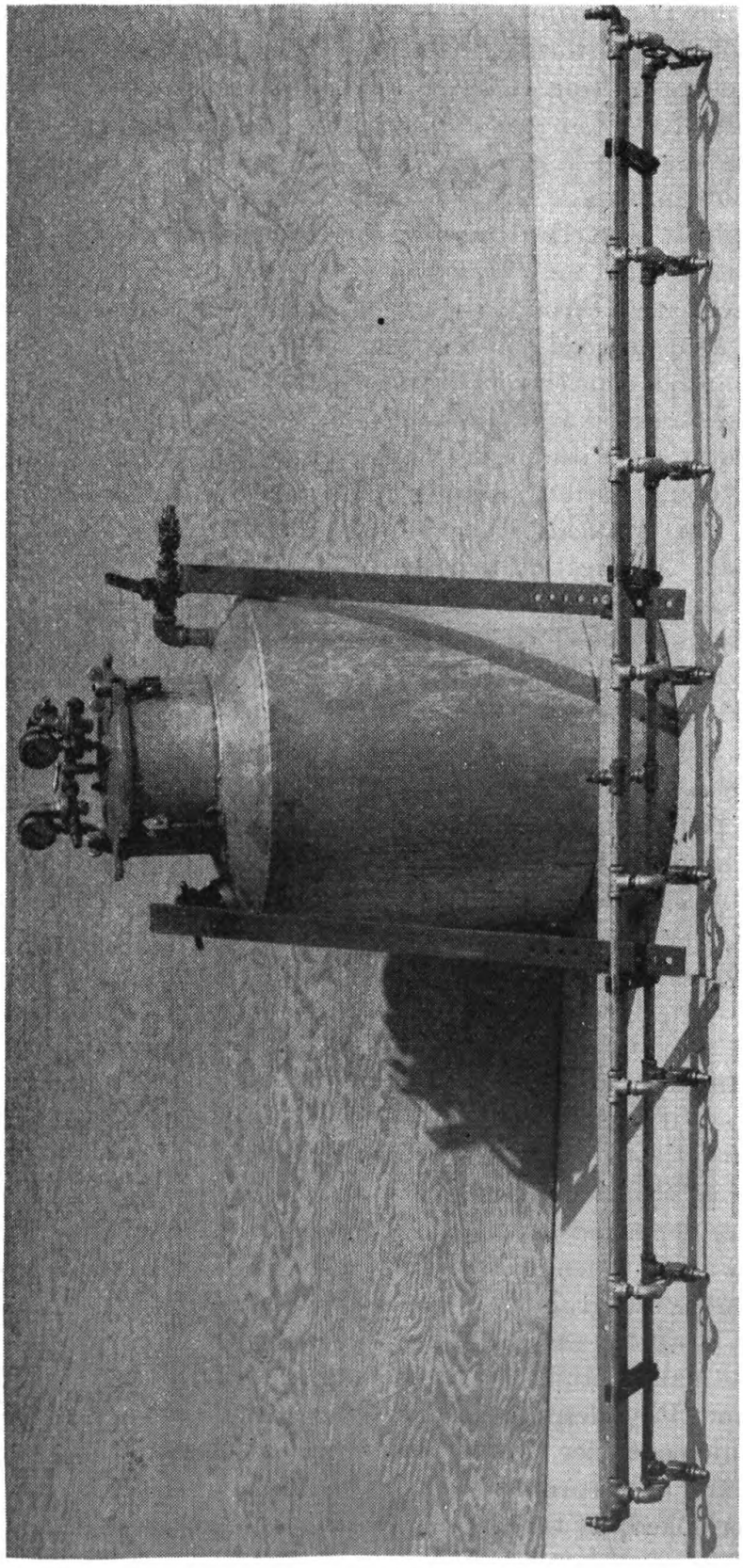

FIGURE 4.—Fifty-gallon pressure tank with improvised spray bar for truck mount.

R. M. S. Fibre Gun, manufactured by R. M. Stephenson, 2059 Webster Street, Oakland, California. It is used in conjunction with a portable air compressor, working at 100 to 150 pounds pressure, which delivers 20 to 30 cubic feet of air per minute. The standard gun is 4 feet long and weighs less than 5 pounds. It is extremely easy to clean and is relatively low in price.

17. Asphalt distributors.—*a.* Bituminous emulsions, cut-backs, and asphalt cements may be applied economically to large paved or hard-surfaced areas through the use of commercial asphalt distributors commonly used on road construction. While equipment of this type varies in detail, it consists of a tank (usually about 800-gallon capacity) to which is connected a gasoline-driven pressure pump and an adjustable pipe equipped with nozzles to deliver the material in a fan-shaped spray. A tubular heater, burning kerosene, extends through the tank, permitting the application of the asphaltic material at any desired temperature. Application temperatures vary from 80° F. to 250° F., depending on the consistency of the product being applied. The distributor pipe is 6 feet long, carries 12 spray nozzles, and is equipped with a 2-foot extension at each end, each extension carrying 4 spray nozzles. Hand-operated flexible extensions are provided for reaching places that cannot be reached by the distributor pipe. The whole unit is mounted on a 4-ton truck. A dial in front of the driver is calibrated in gallons per yard (or similar units) and permits the chauffeur to distribute uniformly any predetermined quantity of asphalt simply by regulating the speed of the truck.

b. The Corps of Engineers has added numerous refinements to the regular commercial type of equipment, and several of the large manufacturers are equipped to turn out machines in accordance with War Department requirements.

18. Granule guns.—For the texturing of roofs or surfaces requiring a uniform distribution of slate granules, or texturing material of a similar nature, a sprayer consisting of a metal tank or container mounted over a small electric-driven blower is highly desirable. The granules are deposited on the adhesive-coated surface through a short metal pipe about 2 feet long. This insures an even and economical distribution of the granules. The whole apparatus is equipped with a shoulder strap for ease in use. Such sprayers are made by several firms; those manufactured by the Benjamin Foster Company, 20th and Erie Avenue, Philadelphia, Pennsylvania, offer the advantage of an open granule container, which may be filled while the machine is in operation, and a dustproof motor. The latter is a feature that should not be overlooked, as the material being sprayed will burn out the

bearings of the motor if it is not completely sealed from dust. Satisfactory guns have also been obtained from the Philip Carey Company, Cincinnati, Ohio.

SECTION IV

MATERIALS—REFERENCE DATA—SURFACE COATINGS

19. Asbestos.

TABLE I

Type and specification	Coverage per unit quantity	Cost per unit quantity	Durability (approximate)	Remarks
Cement paints (powder).	100 sq. ft./gal.	$0.10/lb	10 months	Usually applied with whitewash brush.
Cement paints (oil base).	150 sq. ft./gal.	$1.50/gal	1 to 2 years	Thin according to manufacturer's directions.
Protein-cement paints (powder).	100 sq. ft./gal.	$0.10/lb	1 year	
Bituminous emulsions, T-1224.	200 sq. ft./gal.	$0.60–$1.20/gal.	1 year	Color fades rapidly. Two coats desirable. Use Class A emulsion as a prime coat.
Adhesives				
Bituminous emulsions, T-1224.	100 sq. ft./gal.	$0.12/gal	1 year	Class A.

20. Asphalt and bituminous surfaces.

TABLE II

Type and specification	Coverage per unit quantity	Cost per unit quantity	Durability (approximate)	Remarks
Bituminous emulsions, T–1224.	200 sq. ft./gal	$0.60 to $1.20/gal	1 month under vehicular traffic; 6 to 8 months for runways, with retouching.	Fibrated emulsion can be applied without a prime coat. Use of spray equipment similar to R. M. S. Fibre Gun recommended. Prime coat of Class A emulsion should be used under nonfibrated emulsions.
Oleoresinous traffic paint.	300 sq. ft./gal	$1.25/gal	6 months	Used for marking only.
Adhesives				
Bituminous emulsions, T–1224.	100 sq. ft./gal	$0.12/gal	6 to 8 months	Class A.
Cut-back asphalt	50 sq. ft./gal	$0.15/gal	6 months	Applied hot.
Asphalt cement	12,000 sq. ft./ton.	$23.00/ton	8 to 12 months	Applied hot.

21. Brick, building stone, and slate.

TABLE III

Type and specification	Coverage per unit quantity	Cost per unit quantity	Durability (approximate)	Remarks
Oil paint, T–1215	200 sq. ft./gal	$0.80 to $1.20/gal	1 year	
Cement paints (powder).	100 sq. ft./gal	$0.10/lb	10 months	
Cement paints (oil base).	200 sq. ft./gal	$1.50/gal	1 to 2 years	Thin according to manufacturer's directions.
Protein cement paints (powder)	150 sq. ft./gal	$0.10/lb	1 year	
Bituminous emulsions, T–1224.	200 sq. ft./gal	$0.60 to $1.20/gal	1 year	Color fades rapidly. Prime with Class A emulsion for best results.
Oleoresinous paint (euulsifiable), T1279.	300 sq. ft./gal	$1.50 to $2.00/gal	6 to 8 months	Thin with equal volumes of water or gasoline. Do not use on surfaces subject to abrasion.
Adhesives				
Bituminous emulsions, T–1224.	100 sq. ft./gal	$0.12/gal	1 year	Class A.
Cut-back asphalt	50 sq. ft./gal	$0.15/gal	1 year	Hot application.

22. Burlap and osnaburg.

TABLE IV

Type and specification	Coverage per unit quantity	Cost per unit quantity	Durability (approximate)	Remarks
Oleoresinous paint (emulsifiable), T–1279.	210 to 300 sq. ft./gal.	$1.50 to $2.00/gal.	6 to 9 months	Applied by dipping. Reduce 1 gal. of heavy paste with 3 to 4 gal. Coverage figure is based on reduced paint.
Cold water protein paint, T–1093b.	210 to 300 sq. ft./gal.	$1.00 to $1.75/gal., paste; $0.10 to $0.15/lb., powder.	6 months	Applied by dipping. Coverage figure based on reduced paint.

23. Canvas and duck.

TABLE V

Type and specification	Coverage per unit quantity	Cost per unit quantity	Durability (approximate)	Remarks
Compound for treating tentage, etc., O. Q. M. G. No. 3.				Apply by brush or spray in accordance with instructions of the O. Q. M. G. dated Sept. 10, 1941. Olive-drab color only.

24. Concrete and stucco.

TABLE VI

Type and specification	Coverage per unit quantity	Cost per unit quantity	Durability (approximate)	Remarks
Cement paint (powder).	100 sq. ft./gal	$0.10/gal	10 months	On surfaces not subject to traffic. Under certain conditions fluorescence may cause color to lighten.
Cement paint (oil base).	200 sq. ft./gal	$1.50/gal	1 to 2 years	On surfaces not subject to traffic.
Protein cement paint (powder).	150 sq. ft./gal	$0.10/gal	1 year	Can be used on surfaces subject to light traffic.
Oleoresinous paint (emulsifiable), T–1279.	200 sq. ft./gal	$1.50 to $2.00/gal	6 to 8 months	On surfaces not subject to traffic.
Oil paint, T–1215	200 sq. ft./gal	$0.80 to $1.20/gal	1 year	On surfaces not subject to traffic. Do not use on new work. The free alkali content may burn the paint.
Bituminous emulsions, T–1224.	250 sq. ft./gal	$0.60 to $1.20/gal	1 year	Apply over a prime coat of Class A emulsion. Fibrated type gives more durability on surfaces subject to traffic.
Cut-back asphalt	50 sq. ft./gal	$0.15/gal	6 to 9 months	Hot application.

TABLE VI—Continued

Type and specification	Coverage per unit quantity	Cost per unit quantity	Durability (approximate)	Remarks
Adhesives				
Bituminous emulsions, T-1224.	100 sq. ft./gal.	$0.12/gal	1 year	Class A.
Cut-back asphalt	50 sq. ft./gal.	$0.15/gal	1 year	Hot application.
Stains				
Cement stain, water-dispersible pigment type.	300 sq. ft./gal.	$0.40/gal	9 to 12 months	In conjunction with a top coat of fixing solution.
Tar (RT-2) in xylene	100 sq. ft./gal.	$0.15/gal		
Asphalt in kerosene	100 sq. ft./gal.	$0.11/gal		
Bituminous emulsions, T-1224.	100 sq. ft./gal.	$0.05/gal		Class A—reduce 1 gal. with 3 to 4 gal. of water.

25. Dirt, earth, and sand.

TABLE VII

Type and specification	Coverage per unit quantity	Cost per unit quantity	Durability (approximate)	Remarks
Cinders	600 sq. ft./ton	$6.00/ton	1 year	Subject to maintenance.
Bituminous emulsions, T-1224.	30 sq. ft./gal.	$0.12/gal	1 month	May wash away if subjected to heavy rains. Use Class A only.
Cut-back asphalt	30 sq. ft./gal.	$0.15/gal	1 month	S. C. type. Dilute 50 percent by volume with Diesel oil or crude oil.
Oil	40 sq. ft./gal.	$0.05 to $0.10/gal	2 months	Old crankcase oil—cheapest oil available is satisfactory.

26. Glass.

TABLE VIII

Type and specification	Coverage per unit quantity	Cost per unit quantity	Durability (approximate)	Remarks
Oil paints, T-1215	500 sq. ft./gal.	$0.80 to $1.20/gal.	1 year	If glass is set tightly in frame, painting black is apt to cause cracking from the sun's heat.
Oleoresinous paint (emulsifiable), T-1279.	500 sq. ft./gal.	$1.50 to $2.00/gal.	1 year	Same as oil paint.
Bituminous emulsions, T-1224.	400 sq. ft./gal.	$0.60 to $1.20/gal.	1 year	If fibrated type is used, cloth pressed in, and a second coat applied, protection from flying glass as well as breakage from sun's rays is obtained.
Adhesives				
Oleoresinous varnish	500 sq. ft./gal.	$1.00 to $1.50/gal.	2 years	Throw sand or dirt on glass while varnish is still tacky. This will stop reflection of light and still allow daylight to pass through. This does not effect a blackout.

27. Glass wool.

TABLE IX

Type and specification	Coverage per unit quantity	Cost per unit quantity	Durability (approximate)	Remarks
Flexible, lusterless, fire-resistant enamel.	200 sq. ft./gal.	$2.00/gal.	1 year	Apply by spray. Obtain specially designed paints from qualified manufacturers. Glass wool should be painted at the source of manufacture. Apply paint in the field only for retouching or maintenance.

28. Granite and marble.—For polished marble, see paragraph 26; for rough surface stone, see paragraph 21. Drapes or tarpaulins may be used to avoid permanent injury to surface.

29. Grass.—See paragraph 25, also.

TABLE X

Type and specification	Coverage per unit quantity	Cost per unit quantity	Durability (approximate)	Remarks
Bituminous emulsions, T–1224, Class A.	100 sq. ft./gal.	$0.12/gal.	2 weeks	HRM diluted 1: 3 with water does not kill grass. Does not affect germination of seed. Use non-pigmented type only.

30. Macadam—smooth asphalt.

TABLE XI

Type and specification	Coverage per unit quantity	Cost per unit quantity	Durability (approximate)	Remarks
Bituminous emulsions, T–1224.	200 sq. ft./gal.	$0.60 to $1.20/gal.	1 month under traffic, 6 to 8 months otherwise.	Two coats desirable. Prime with Class A. Fibrated emulsion stands up better on surfaces subject to traffic.
Oleoresinous traffic paint.	300 sq. ft./gal.	$1.25/gal.	6 months	For marking only.
Adhesives				
Bituminous emulsions, T–1224.	100 sq. ft./gal.	$0.12/gal.	6 to 8 months	If green color is desired, texture with sawdust and spray with green water dispersible pigment. No fixing coat required.

31. Metal already coated.—Recommended primer coatings for unpainted metal: Corps of Engineers Tentative Specification No. T-1103.

TABLE XII

Type and specification	Coverage per unit quantity	Cost per unit quantity	Durability (approximate)	Remarks
Oil paints, T-1215	400 sq. ft./gal	$0.80 to $1.20/gal	1 year	Surface must be clean and free from rust.
Lusterless enamel, T-1184.	450 sq. ft./gal	$1.50 to $2.00/gal	1 year	Apply in accordance with specification.
Oleoresinous paint (emulsifiable), T-1279.	400 sq. ft./gal	$1.50 to $2.00/gal	9 months	Suitable for temporary use.
Adhesives				
Bituminous emulsions, T-1224.	100 sq. ft./gal	$0.12/gal	1 year	Class A.

32. Metal, galvanized.

TABLE XIII

Type and specification	Coverage per unit quantity	Cost per unit quantity	Durability (approximate)	Remarks
Cement paint (oil base).	300 sq. ft./gal	$1.50/gal	1 year	L & S or equal. Can be applied over a clean surface without any preliminary treatment.
Phenolic resin paint	250 sq. ft./gal		9 to 12 months	Wonderguard or equal. Can be applied over a clean surface without any preliminary treatment. Spray application preferred.

a. Sandblasting is the most effective treatment for all conditions of the surface. This method cleans and etches in one operation. It is desirable to paint as soon as possible after sandblasting.

b. A method found highly effective for cutting grease and etching the surface in a single operation is to apply liberally, with an oil-free brush, an acidified mixture of denatured alcohol, toluol, and carbon tetrachloride. It should be noted, however, that if a large quantity of grease is present it will again spread on the surface when the solvent evaporates, and for careful work supplementary cleaning may be necessary. The solution may be prepared approximately as follows:

	Volumes
Denatured alcohol	60
Toluol	30
Carbon tetrachloride	5
Commercial concentrated hydrochloric acid (muriatic acid)	5

c. Many commercial treating solutions which deposit films of antimony, etc., have been found effective.

d. If the surface has weathered or is originally free from oil or grease, brushing with, or dipping the surface in, a solution of copper acetate (6 ounces per gallon) in water etches the surface quite well. The weakness of this method is that it does not dissolve oil or grease and hence will not etch greasy surfaces thoroughly.

e. Merely washing the surface with toluol or some solvent in which the oils or grease are soluble will serve in many cases and especially for interior work. If the surface is not exposed to extreme temperature changes, a thoroughly cleaned zinc surface provides sufficient anchorage for the paint film, assuming that the paint is one that can be expected to adhere.

f. Pretreatments which deposit films of copper on the metal have been used widely for many years. Experience with them has been erratic, probably because these deposits seem to have a general tendency to be loosely adherent and powdery. If such treatments are used, the removal of all powdery material must be assured by brushing or by scrubbing with water.

33. Mineral-coated roofing.

TABLE XIV

Type and specification	Coverage per unit quantity	Cost per unit quantity	Durability (approximate)	Remarks
Bituminous emulsions, T–1224.	200 sq. ft./gal.	$0.60 to $1.20/gal.	9 months	Fades rapidly. Do not apply in cold, damp weather.
Oleoresinous paint (emulsifiable), T–1279.	300 sq. ft./gal.	$1.50 to $2.00/gal.	9 months	Coverage based on reduced paint. Can be applied in cold, damp weather.
Oil paint, T–1215	300 sq. ft./gal.	$0.80 to $1.20/gal.	1 year	Staining may occur if bituminous material is present in the roofing.
Adhesives				
Bituminous emulsions, T–1224.	100 sq. ft./gal.	$0.12/gal.	1 year	Class A. Use undiluted.

34. Netting.—If netting is not treated with tar, see paragraph 22.

TABLE XV

Type and specification	Coverage per unit quantity	Cost per unit quantity	Durability (approximate)	Remarks
Bituminous emulsions, T–1224.		$0.60 to $1.20/gal	1 year	Dilute according to manufacturer's directions. Apply by dipping.
Oleoresinous paint (emulsifiable), T–1279.		$1.50 to $2.00/gal	1 year	Dilute 1 gal. with 3 to 4 gal. water. Apply by dipping.

35. Roofing paper (not mineral-coated).

TABLE XVI

Type and specification	Coverage per unit quantity	Cost per unit quantity	Durability (approximate)	Remarks
Oleoresinous paint (emulsifiable), T–1279.	300 sq. ft./gal	$1.50 to $2.00/gal	9 months	Coverage based on reduced paint.
Bituminous emulsions, T–1224.	200 sq. ft./gal	$0.60 to $1.20/gal	9 months	Fades rapidly. Do not apply in cold, damp weather.
Adhesives				
Bituminous emulsions, T–1224.	100 sq. ft./gal	$0.12/gal	1 year	Class A. Do not apply in rain.
Bituminous adhesive	40 sq. ft./gal	$0.50/gal	1 year	Insulmastic, Philip Carey, or equal.

36. Steel wool.

TABLE XVII

Type and specification	Coverage per unit quantity	Cost per unit quantity	Durability (approximate)	Remarks
Lusterless enamel, T–1184.	200 sq. ft./gal	$1.50 to $2.00/gal	1 year	Apply by spraying.
Lusterless fire-retardant paint.	200 sq. ft./ gal	$1.50 to $2.00/gal	1 year	Apply by spraying. Obtain from qualified manufacturers. Should pass requirements of paint for Spec. No. T–1284.
Oil paint, T–1215	100 sq. ft./ gal	$0.80 to $1.20/gal	6 months	Apply by spraying. For maintenance use only.

37. Terra cotta tile.—See paragraph 21 for unglazed terra cotta and paragraph 26 for glazed terra cotta; see paragraph 24 for stains.

38. Water.

TABLE XVIII

Type and specification	Coverage per unit quantity	Cost per unit quantity	Durability (approximate)	Remarks
Bitudobe brick				Grind to powder and sprinkle on water. Forms a black film that floats for days.

39. Wood.

TABLE XIX

Type and specification	Coverage per unit quantity	Cost per unit quantity	Durability (approximate)	Remarks
Oil paints, T-1215	300 sq. ft./gal	$0.80 to $1.20/gal	1 year	Unpainted wood or surfaces in very poor condition should be primed with oil base primer, Spec. No. T-1287.
Oleoresinous paint (Emulsifiable).	300 sq. ft./gal	$1.50 to $2.00/gal	6 to 9 months	Same as for oil paints.
Adhesives				
Bituminous emulsions, T-1224.	100 sq. ft./gal	$0.12/gal	1 year	Class A. Apply undiluted.
Stains				
Oil stains	400 sq. ft./gal	$0.60/gal	1 year	Does not preserve the wood as well as oil paint.
Creosote stain	400 sq. ft./gal	$0.50/gal	1 year	Cannot be painted over with oil paint in light colors on account of staining from the creosote.

40. Fabrics, garnish, granules, and powders.

TABLE XX

Type and specification	Quantity per 1,000 sq ft.	Cost per unit quantity	Durability (approximate)	Remarks
Asbestos (long and short fiber) paper stock, shingles, corrugated siding.				Fireproof material.
Burlap			Depends on whether rot-proofed, mildew-proofed, etc.	Obtained colored for garnishing under Spec. No. T-1212.
Chicken feathers	15 lbs	$0.06 to $0.12½/lb		½ HRM and ½ thick flour paste makes a good adhesive.

TABLE XX—Continued

Type and specification	Quantity per 1,000 sq ft.	Cost per unit quantity	Durability (approximate)	Remarks
Chicken wire and wire mesh.				Spec. No. T-1481A and Spec. No. T-1288.
Cinders	⅛ ton	$6.00/ton	Depends on usage	Various sizes. Obtain from local sources.
Corncob chips			Fair; nonwearing surface.	Obtain locally. Can be chipped on a silage cutter.
Glass wool		$0.50/sq. yd. garnished netting.	Excellent	Fiber glass type. Used on wire mesh as overhead cover.
Net, fish				Spec. No. T-1534. Garnished, Spec. No. T-1220.
Net, shrimp				¼-to ½-in. mesh. Use as a drape.
Osnaburg			Depends on method of treatment; 6 to 9 months.	Obtained colored for garnishing under Spec. No. T-1212.
Rolled roofing			Good	Can be obtained with or without a mineral coating.
Sawdust	100 to 150 lb			Excellent texturing material for runways. In damp climates, precoloring the sawdust reduces the porosity.
Silage (dried)			Fair nonwearing surface.	Obtain from farmers.
Slate granules	0.3 ton	$30 to $35/ton	Very good	Can be obtained in standard camouflage colors.
Spanish moss		$75/ton		Suitable where it can be obtained locally.
Steel wool		$0.60/sq. yd. garnished netting.	1 year	Greater durability by proper maintenance.
Trap rock, gravel, or slag.	1¼ tons	$2.00/ton	Very good; depends on usage.	Obtain locally.
Visinet, ⅛-in. mesh.		$0.06 to $0.08/yd	3 to 6 months	Paper twine net.
Wood chips, tan bark, etc.	Depends on size of chips.			Best size of wood chips, 1½ by 1- by ¼-in. Should be solid, not chewed or frayed.

SECTION V

OVERHEAD CONCEALMENT AND SCREENING

41. General.—Overhead concealment may be secured by the use of any of several standard types of garnished netting. Most of these may be procured in accordance with specifications of the Corps of Engineers. They are erected on frameworks of wood or steel and fastened securely in a horizontal plane. If allowed to sag appreciably, shadows will be formed which will show up dark in aerial photographs. Wherever possible, overhead screens should be tied in with some natural feature of the landscape, such as groves of trees, shrubbery, hedges, etc., in order to further break up the edges of the screen. Paragraphs 42 to 47, inclusive, describe some of the standard types of screening available.

42. Fish nets, garnished (Corps of Engineers Tentative Specification No. T–1220).—*a.* Fish nets may be secured garnished with burlap or osnaburg in accordance with a definite pattern which is the result of careful studies of aerial photographs of many types of patterns. Garnish strips 2 inches wide and 5 feet in length are woven into the mesh, being knotted around the mesh at each end. The strips are placed close together in the center of the net, securing 90 percent coverage; they are thinned out in an irregular manner so as to secure approximately 50 percent coverage toward the edges. A 30- by 30-foot net requires about 460 strips when garnished in a proper manner. Garnishing may be carried out in the field, using fabric procured in accordance with Corps of Engineers Tentative Specification No. 1212. If this is done, it is estimated that a 30- by 30-foot net will require 8 rolls of 2-inch fabric 100 yards in length, or 115 yards of 40-inch fabric.

b. Garnished fish nets find their greatest use in mobile situations; however, they are suitable for semipermanent screening. Their average life is 6 months. Since they shrink in wet weather and stretch in dry weather, a certain amount of attention is required constantly to keep them in proper condition.

43. Nets, camouflage, wire, fabric garnished (Corps of Engineers Tentative Specification No. T-1219).—Wire netting garnished with precolored fabric is available for use in fabricating overhead covers. Burlap or osnaburg, impregnated in accordance with Corps of Engineers Tentative Specification No. T-1212, is secured by sewing or stapling to a wire mesh. The fabric is applied in a definite pattern as shown in the drawing attached to Specification No. T-1219. It is not woven through the mesh as is the case with fish nets. It is supplied in rolls 6 feet wide and 50 yards long. Wire nets do not require the maintenance that is necessary when fish nets are used, as there is no problem of shrinkage or expansion. The durability is limited by the life of the fabric; 6 months is average.

44. Steel wool (Corps of Engineers Tentative Specification No. T-1284).—*a.* Steel wool, wired to a chicken wire mesh which in turn is carried on wire supported by tubular steel or wooden frameworks, is used in connection with the concealment of permanent installations. It is valuable in areas where the fire hazard is high. It is effective against incendiary bombs, especially if the camouflaged surface is so sloped as to allow many of the bombs to roll off. Its inherent texture stands up under close inspection from hedge-hopping airplanes and presents a surface closely resembling grass. The garnished wire must be manufactured strictly in accordance with specifications in order to provide durability and protection against corrosion. The steel wool is spread on the wire mesh, using 10 to 12 ounces of steel wool per square yard, and secured with wire staples. The net is then passed through a bonderizing or parkerizing bath to give a rustproof surface and then through a paint bath of the desired color. The paint has been specially designed to further rustproof as well as to color the steel wool. The netting normally is supplied in rolls 75 feet in length and of width as specified, usually 5 or 6 feet.

b. Properly manufactured steel wool nets should show no rusting for a 1- to 2-year period. Steel wool garnished netting should be available for approximately 65 cents per square yard in large quantities. If touching up of the surface or changing of the color is required, only paint specially designed for the purpose should be used. Such a paint will dry to a flat finish and be highly resistant to rust. It may be obtained from any of the manufacturers of steel wool garnished netting and should be procured in accordance with the finish specified in Corps of Engineers Specification No. T-1284. If these precautions are taken, trouble with premature rusting and corrosion will be avoided.

45. Glass wool.—Wire netting covered with glass wool of the type used in the textile industry may be used in place of steel wool, thus conserving essential steel. Glass wool of this type is supplied in thread or fibers, each fiber composed of over 200 filaments of glass. This results in a fiber of a very soft, pliable nature, having great durability. The material is light, 1½ to 3 ounces per square yard, giving sufficient density for camouflage purposes. Only the wire netting requires a rustproofing treatment, as glass is not subject to corrosion. The completed mat should be subjected to a thorough spray painting, as dipping tends to mat the glass wool, cutting down on its hiding properties. Tests are under way at the present time on the adaptability of a coarse fiber glass wool to a camouflage net which can be painted by dipping in a similar manner to steel wool. In addition to being a material readily available, glass wool garnished mesh is cheaper than steel wool, costing approximately 55 cents per square yard, based on a density of 3 ounces per square yard.

46. Chicken feathers.—*a.* Chicken feathers on wire, a new technique recently developed, has proved valuable, especially in rocky country. A 1-inch mesh black iron chicken wire is passed through a trough of adhesive and while still warm and tacky is covered with chicken feathers to a depth of approximately 2 inches. The wire is rolled immediately and stood on end to dry. This permits the feathers to adhere to both surfaces of the wire and holds them firmly in place until the glue sets. The material is flexible and may be bent over supports to imitate rocky structures. When first installed, the feathers are lighter in tone than the surrounding rock, but after the first rain has wilted the feathers and dust and dirt have settled on them, they darken; from a short distance they are hard to distinguish from the rocky outcropping. A satisfactory adhesive can be prepared by mixing equal quantities of bituminous emulsion (nonpigmented) and thick flour paste.

b. A variation of the above consists of securing irregularly shaped pieces of burlap on the chicken feathers. The burlap is colored to imitate surrounding rock formations. When a net prepared in this manner is shaped into forms to imitate surrounding formations, the burlap portion takes on the appearance of bare rocks and the feathers give the illusion of vegetation surrounding the rock. The feather-coated mesh may also be used for dummy and decoy construction, and as a flat top or overhead screen. It is supported in the same manner as steel wool and similar materials. The net is quite flame-resistant. The feathers will burn as long as they are exposed to an open flame, but the area surrounding the actual flame remains unscathed.

c. It has been found that by using a long quill feather, 2-inch wire mesh can be substituted for the 1-inch size. The former is only about one-half as expensive. Suitable standard feathers, dried and fluffed with the quill intact, may be obtained for about 12½ cents per pound. The color of the untreated feathers can be controlled by proper selection. White feathers may be used to simulate snow or light-colored sand; for tan sand or soil, a mixture of one-half Rhode Island Red and one-half white has given good results. Reddish earth may be imitated with straight Rhode Island Red feathers, while for gray granite, Plymouth Rock or turkey feathers are suitable. Where obtainable, duck feathers may be used; they are highly water-repellent and do not mat down in wet weather. If chicken feather construction is used to imitate grass, bushes, or trees, the feathers can be sprayed with green bituminous emulsion.

47. Vegetable fibers and seaweed.—Several other substitutes for steel wool are under experimentation at the present time and show considerable promise. While they cannot be given full approval as yet, a description of their possibilities follow.

a. Vegetable fibers, such as hemp-like Tula, may be stapled to chicken wire mesh in a manner similar to steel wool. These fibers are hard, tough, and durable, and their texture is excellent. They may be dip-painted and, like glass wool, present no corrosion problem. They are spread over the mesh at a rate of about 1 pound per square yard. Their greatest disadvantage to date has been their inflammability. It is highly possible that this may be overcome in the near future through the use of a fire-resistant paint. If this is accomplished, or in circumstances where this factor is not of importance, such materials offer a valuable addition to those available for screening and overhead cover. The price, being approximately 35 to 40 cents a square yard, is attractive.

b. The alginate content of kelp or seaweed may be extracted by alkalies and spun into fibers by extruding the dissolved alginate into a bath of calcium chloride. The resulting calcium alginate may be fastened to wire mesh. From 1 to 2 pounds per square yard are required to furnish satisfactory hiding. The material may be painted by dipping, and it possesses excellent texture. It is very elastic and durable when used in moist climates, but dries out and becomes very brittle under dry conditions. Work being done at present indicates the possibility of permanently plasticizing the calcium alginate, and if this can be accomplished it will take its place along with the other substitutes for steel wool. The cost will probably be about the same as for the vegetable fiber type of screen.

SECTION VI

MANUFACTURERS

48. General.—*a.* The list of manufacturers (par. 49) is given for the sole purpose of furnishing a guide as to where a material or paint of a certain description can be obtained. It must in no way be taken as an indorsement of the product of any manufacturer. The omission of any vendor from this list is no indication that his product is not satisfactory, or is inferior in any way to the products of the manufacturers listed.

b. In the preparation of this manual in a limited time it was not possible to include all the manufacturers of a particular product, and the information as to manufacturers is based on contacts established by the Engineer Board. This list will be supplemented as revision becomes desirable, and additional manufacturers will be included as experience dictates.

c. Officers using this information should not permit the listing of manufacturers to act to the prejudice of unlisted manufacturers. The intent is to indicate the widespread availability and application of the material and not the exclusive use of any single material.

49. Partial list of manufacturers.—*a. Bituminous emulsions.*

American Bitumuls Co., Baltimore, Md.
Barber Co., The, Barber, N. J.
Barrett Co., The, New York, N. Y.
Carey Co., Philip, Cincinnati, Ohio.
Flintkote Co., The, New York, N. Y.
Foster Co., Benjamin, Philadelphia, Pa.
General Paint Corp., Cleveland, Ohio.
Glidden Co., The, Cleveland, Ohio.
Hilo Varnish Co., Brooklyn, N. Y.
Koppers Co., The, Pittsburgh, Pa.
Lasting Products Co., Baltimore, Md.
Reilly Tar and Chemical Corp., Indianapolis, Ind.
Socony Vacuum Oil Co., New York, N. Y.

b. Bituminous adhesive.

Carey Co., Philip, Cincinnati, Ohio.
Foster Co., Benjamin, Philadelpha, Pa.
Insulmastic Corp. of America, New York, N. Y.

c. Cement paints (cement binder).
General Paint Co., San Francisco, Calif.
Horn Co., A. C., Long Island City, N. Y.
Kon Kre Kota Co., Portland, Oreg.
Lasting Products Co., Baltimore, Md.
Medusa Portland Cement Co., Cleveland, Ohio.

d. Cement paints (oil base).
Devoe & Reynolds Co., New York, N. Y.
General Paint Corp., Los Angeles, Calif.
Themec Mfg. Co., Kansas City, Mo.

e. Cement and protein paints.
Glidden Co., The, Cleveland, Ohio.
Reardon Co., The, St. Louis, Mo.
Wesco Waterpaints, Inc., East Boston, Mass.

f. Cold water protein paints.
Atlantic Calsomine Co., Brooklyn, N. Y.
Baltimore Paint & Color Works, Inc., Baltimore, Md.
Casein Products Co., Boston, Mass.
General Finishes, Inc., St. Paul, Minn.
Glidden Co., The, Cleveland, Ohio.
Liberty Chem. & Mfg. Co., Bound Brook, N. J.
Muralo Co., The, Staten Island, N. Y.
Pittsburgh Plate Glass Co., Pittsburgh, Pa.
Pratt Paint & Varnish Co., Dallas, Tex.
Prescott Paint Co., Inc., New York, N. Y.
Reardon Co., St. Louis, Mo.
Resinite Co., Flushing, N. Y.
Sapolin Co., Inc., New York, N. Y.
Sherwin Williams Co., Cleveland, Ohio.
Thompson & Co., Pittsburgh, Pa.
U. S. Gypsum Co., Chicago, Ill.
Wesco Waterpaints, Inc., East Boston, Mass.

g. Crude oil (road oil).
Atlantic Refining Co., Philadelphia, Pa.
Barrett Co., The, New York, N. Y.
Gulf Refining Co., Pittsburgh, Pa.
Sinclair Refining Co., Marcus Hook, Pa.
Socony Vacuum Oil Co., Inc., New York, N. Y.
Standard Oil Co. of N. J., New York, N. Y.
(Local oil dealers.)

h. Cut-back asphalt.

American Bitumuls Co., Baltimore, Md.
Barber Asphalt, Barber, N. J.
Barrett Co., The, New York, N. Y.
Koppers Co., The, Pittsburgh, Pa.
Neville Co., The, Pittsburgh, Pa.
Pittsburgh Coal Carbonization Co., Pittsburgh, Pa.
Reilly Tar & Chemical Co., Indianapolis, Ind.
Republic Chemical Co., New York, N. Y.
Sinclair Refining Co., Marcus Hook, Pa.
Socony Vacuum Oil Co., New York, N. Y.
Standard Oil Co. of New Jersey, New York, N. Y.

i. Gasoline soluble paint.

R. B. H. Dispersions, Inc., Bound Brook, N. J.
du Pont de Nemours & Co., E. I., Wilmington, Del.

j. Glue.

Adhesive Products Co., Seattle, Wash.
Casein Co. of America, Div. of the Borden Co., New York, N. Y.
General Finishes, Inc., St. Paul, Minn.
LePage Glue Products, Inc., Gloucester, Mass.
Royal Glue Co., Baltimore, Md.
Williamson Adhesives, Inc., Chicago, Ill.

k. Lusterless enamel.

Arco Co., Cleveland, Ohio.
Ault and Wiborg, Cincinnati, Ohio.
Baltimore Paint & Color Works, Inc., Baltimore, Md.
Chipman Chemical Co., Bound Brook, N. J.
Devoe & Reynolds, New York, N. Y.
du Pont de Nemours & Co., E. I., Wilmington, Del.
Felton Sibley & Co., Inc., Philadelphia, Pa.
Hilo Varnish Co., Brooklyn, N. Y.
Lasting Products Co., Baltimore, Md.
Pittsburgh Plate Glass Co., Pittsburgh, Pa.
Pratt Paint & Varnish Co., Dallas, Tex.
Rowe Paint & Varnish Co., Inc., Niagara Falls, N. Y.
Sherwin Williams Co., Cleveland, Ohio.
Sterling Varnish Co., Malden, Mass.
Thompson & Co., Pittsburgh, Pa.
Trusion Labs, The, Detroit, Mich.
Valentine & Co., Long Island City, N. Y.
Vita Var Corp., Newark, N. J.

l. Oil paints.

Arco Co., Cleveland, Ohio.
Ault & Wiborg, Cincinnati, Ohio.
Devoe & Reynolds, New York, N. Y.
du Pont de Nemours & Co., Inc., E. I., Wilmington, Del.
Felton Sibley & Co., Inc., Philadelphia, Pa.
Glidden Co., Cleveland, Ohio.
Lasting Products Co., Baltimore, Md.
Pittsburgh Plate Glass Co., Pittsburgh, Pa.
Sapolin Co., New York, N. Y.
Sherwin Williams Co., Cleveland, Ohio.
Vita Var Corp., Newark, N. J.

m. Oil stains (and creosote stains).

Atlas Powder Co., Wilmington, Del.
Cabot, Samuel, Inc., Boston, Mass.
du Pont de Nemours & Co., Inc., E. I., Wilmington, Del.
Enterprise Paint Co.
Hilo Varnish Co., Brooklyn, N. Y.
Reilly Tar & Chemical Corp., Indianapolis, Ind.
Sapolin Co., Inc., New York, N. Y.
Vita Var Corp., Newark, N. J.

n. Oleoresinous emulsifiable paints.

Ault & Wiborg, Cincinnati, Ohio.
Glidden Co., Cleveland, Ohio.
Thibaut-Walker Co., Long Island City, N. Y.
Vita Var Corp., Newark, N. J.

o. Pigments (dry).

Calco Chemical Division, American Cyanamid Co., Bound Brook, N. J.
Harmon Color Works.
Kentucky Color & Chemical Co., Louisville, Ky.
Krebs Pigment & Color Corp., Wilmington, Del.
McNulty, Joseph, New York, N. Y.
Moran, Charles J., Montclair, N. J.
Reichard Coulston Co., New York, N. Y.
Reichhold Chemicals, Inc., Elizabeth, N. J.
Smith & Co., J. Lee, New York, N. Y.
United Color & Pigment Co., Newark, N. J.
Williams, C. K., Easton, Pa.

p. Roofing tars.

Barrett Co., The, New York, N. Y.
Barber Asphalt, Barber, N. J.

p. Roofing tars—Continued.
Bird & Sons, Inc., East Walpole, Mass.
Cann Co., H. E., Baltimore, Md.
Carey Co., Philip, Cincinnati, Ohio.
Flintkote Co., The, New York, N. Y.
Johns-Manville Corp., New York, N. Y.
Reilly Tar & Chemical Corp., Indianapolis, Ind.
Republic Chemical Co., New York, N. Y.
Ruberoid Co., The, New York, N. Y.
Wishnick-Tumpeer Inc., New York, N. Y.

q. Soil binders.
American Bitumuls Co., Baltimore, Md.
Barrett Co., The, New York, N. Y.
Socony Vacuum Oil Co., New York, N. Y.
Standard Oil Co. of N. J., New York, N. Y.

r. Topping asphalt.
Barber Co., Inc., The, Barber, N. J.
Carey Co., Philip, Cincinnati, Ohio.

s. Traffic paints.
Arco Co., The, Cleveland, Ohio.
Baltimore Paint & Color Works Inc., Baltimore, Md.
du Pont de Nemours & Co., Inc., E. I., Wilmington, Del.
Glidden Co., Cleveland, Ohio.
Globe Paint Works, Inc., Williamsport, Pa.
Hilo Varnish Co., Brooklyn, N. Y.
King & Co., Inc., E. & F., Springfield, Mass.
Pittsburgh Plate Glass Co., Pittsburgh, Pa.
Pratt Paint & Varnish Co., Dallas, Tex.
Reilly Tar & Chemical Corp., Indianapolis, Ind.
Rowe Paint & Varnish Co., Inc., Niagara Falls, N. Y.
Sherwin Williams Co., Cleveland, Ohio.
Thompson & Co., Pittsburgh, Pa.
Vita Var Corp., Newark, N. J.

t. Asbestos (*and asbestos materials*).
Acme Asbestos Covering & Flooring Co., Chicago, Ill.
American Asbestos Co., Norristown, Pa.
Asbestos Textile Co., Inc., Chicago, Ill.
Asbestos Corp. of America, New York, N. Y.
Carey Co., Philip, Cincinnati, Ohio.
Gatke Corporation, Chicago, Ill.
Johns-Manville, New York, N. Y.
Keasby & Mattison Co., Ambler, Pa.

t. Asbestos (*and asbestos materials*)—Continued.
Marshal Asbestos Corp., Troy, N. Y.
Minerals & Insulation Co., New York, N. Y.
Ruberoid Co., The, New York, N. Y.
Standard Asbestos Mfg. & Insulating Co., Kansas City, Mo.
Standard Asbestos Mfg. Co. of Chicago, Chicago, Ill.
United States Asbestos Co. of Illinois, Chicago, Ill.

u. Burlap.—Procure from Army depots.

v. Canvas.—Procure from Army depots.

w. Chicken feathers.
Mitchell, P. R., Co., The, Cincinnati, Ohio.
Prescott, W. & Co., San Francisco, Calif.
Rock River Cotton Co., Janesville, Wis.
Vitkin-Lee Feather Co., Chicago, Ill.

x. Expanded metal (*and metal lath*).
American Rolling Mills Co., The, Middleton, Ohio.
Berger Mfg. Division, Republic Steel Corp., Canton, Ohio.
Milcor Steel Co., Milwaukee, Wis.
Wheeling Steel Corp., Wheeling, W. Va.
(Consult local building supply house.)

y. Glass wool garnished netting.
Armstrong Cork Co., Lancaster, Pa.
Parker-Wolverine Co., Detroit, Mich.

z. Osnaburg—Procure from Army depots.

aa. Rolled roofing.
American Asphalt Roof Corp., Kansas City, Mo.
American Bitumuls Co., Baltimore, Md.
Barber Asphalt Corp., Barber, N. J.
Barrett Co., The, New York, N. Y.
Bird & Son, Inc., East Walpole, Mass.
Carey Co., Philip, Cincinnati, Ohio.
Flintkote Co., The, New York, N. Y.
Koppers Co., Philadelphia, Pa.
Ruberoid Co., New York, N. Y.

ab. Slate—crushed (*also stone or ceramic*) *granules.*
Bird & Son, Inc., East Walpole, Mass.
Flintkote Co., The, New York, N. Y.
Funkhouser Co., The, Hagerstown, Md.
Mid-West Roofing Co., Mason City, Iowa.
Parsons Mfg. Co., Pen Argyl, Pa.

ac. Spanish moss.—Southern Moss Co., Inc., Tampa, Fla.

ad. Steel wool garnished netting.

Armstrong Cork Co., Lancaster, Pa.
Cary-McFall Co., Philadelphia, Pa.
Parker-Wolverine Co., Detroit, Mich.
Young Co., L. A., Detroit, Mich.

ae. Visinet.

Auer, J. F., Co., New York, N. Y.
Bemis Bros., Brooklyn, N. Y.
Bemis Bros. Bag Co., St. Louis, Mo.
Chase Bag Co., New York, N. Y.

APPENDIX

SPECIFICATIONS, CAMOUFLAGE MATERIAL AND EQUIPMENT

1. U. S. Army Specifications.

100–12	Method of test for infrared reflectance.

2. Corps of Engineers, U. S. Army Tentative Specification.

T–1093b	Paint, coldwater, protein binder, camouflage.
T–1103	Primer, olive drab glyceryl, phthalate.
T–1153B	Paint spray unit (portable).
T–1183	Enamel, phenolic, olive drab, lusterless.
T–1184B	General specificatıcns for finishing, treating, and painting.
T–1212	Fabric, impregnated, camouflage.
T–1213A	Camouflage colors.
T–1215	Paint, camouflage, ready-mixed oil type.
T–1219	Nets, camouflage, wire, fabric garnished.
T–1220	Net, camouflage, twine, fabric garnished.
T–1224	Bituminous emulsions, camouflage.
T–1226	Compound, camouflage (removable).
T–1227	Paint, camouflage, gasoline-soluble.
T–1271	Paint spraying equipment for air compressor unit.
T–1279	Paint, camouflage, oleoresinous (emulsifiable).
T–1284	Nets, camouflage, wire, steel wool garnished.
T–1287	Paints, camouflage, primer for wood, oil type.
T–1288	Nets, camouflage, welded wire.
T–1291	Paint spraying unit (mobile) (tarrant).
T–1359A	Compressor, air, motorized.
T–1481A	Nets, camouflage, wire.
T–1534	Nets, camouflage.
T–1564	Machine, paint mixing, 50-gallon capacity, electric motor driven.
T–1565	Wringer, roll, rubber.
T–1566	Cutter, cloth, disk type, electric, portable.
T–1567	Net set, camouflage No. 1 (3-inch AA gun).
T–1571	Net set, camouflage No. 2 (light and medium FA).
T–1573	Barracks, prefabricated, plywood.

T–1574	Wringer, roll, 12-inch with vat (portable).
T–1575	Pneumatic agitator.
T–1583	Paint spraying unit, atomization type (mobile).

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BY ORDER OF THE SECRETARY OF WAR:

G. C. MARSHALL,
Chief of Staff.

OFFICIAL:

J. A. ULIO,
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(For explanation of symbols see FM 21–6.)

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